Today

- HW4 due (for reals)
- Next reading presentations: Weds, Feb 16 (R19)
- Experimental methods (through the example of discourse coherence)

Today

- Developing an experiment
  - Defining a research question
  - Operationalizing it
  - Design details

Defining a research question (you already know this)

Your research question is what you want to know. It should be:

- Novel (don't waste a year in the lab to save an hour in the library)
- Answerable
- Interesting (because it bears on some broader issue)

Defining a research question

- A sample question:

  How do people interpret pronouns?

- This would be a good research question (in 2002):
  - Novel: existing research didn't answer it
  - Answerable: using self-paced reading
  - Interesting: answering it could distinguish among three theories of pronoun processing

Defining a research question

- Centering Theory: Comprehenders assume that pronouns refer the the subjects of preceding sentences
  - *Ann thanked Bob, and she congratulated Carl.* (easier)
  - *Ann thanked Bob, and he congratulated Carl.* (harder)
- Parallel Preference Account: Comprehenders assume that pronouns refer to antecedents in the same position in preceding sentences
  - *Ann thanked Bob, and Carl congratulated him*. (easier)
  - *Ann thanked Bob, and Carl congratulated her.* (harder)
- Discourse Coherence Account: Comprehenders try to figure out the logical relation between the clauses, and interpret pronouns accordingly
  - *Ann promoted Sue because she worked hard.* (cause-effect)
  - *Ann promoted Sue because she had a vested interest.* (cause-effect)
  - *Ann promoted Sue and Liz showed her the ropes.* (resemblance)
  - *Ann promoted Sue but Liz tried to sabotage her.* (resemblance)

Operationalizing a question

- To answer your research question
  - you have to transform it into a question about causation, namely, *does X cause Y?*
  - X is something that you can manipulate
  - Y is something that you can measure, like how long it takes someone to read a word or how often they pick one word or the other, etc.
  - Then you can ask whether manipulating X in a particular way causes differences in measurements of Y

Operationalizing a question

- Do people have different levels of difficulty in processing pronouns, depending on the coherence relations between clauses?

Operationalizing a question

Independent variables and dependent variables

- The thing you manipulate and that might affect the dependent variable is an *independent variable* or *factor*
  - Age, gender, handedness, etc. of the speaker
  - Native language of the experimental subject
  - Whether an image and a verb match

- A potentially affected thing, which can be directly and reliably measured, is a *dependent variable* or *dependent measure*
  - Time to press a button.
  - Reading time for a word or sentence
  - Number of words remembered
  - Number of times a particular word is used

Operationalizing a question

Variables can be treated as *continuous* or *categorical*

- *Categorical* variables have more than one *level* or *condition*
  - Whether the second clause is related to the first one through cause-effect or resemblance
  - Whether the pronoun reference is parallel or not

- *Continuous* variables are measured on a scale
  - The reaction time (in miliseconds) to press a button

Operationalizing a question

- Resemblance, Parallel Reference

  Fiona complimented Craig and similarly James congratulated him after the match but nobody took any notice.
- Resemblance, Nonparallel Reference

  Fiona complimented Craig and similarly James congratulated her after the match but nobody took any notice.
- Cause-Effect, Parallel Reference

  Fiona defeated Craig and so James congratulated him after the match but nobody took any notice.
- Cause-Effect, Nonparallel Reference

  Fiona defeated Craig and so James congratulated her after the match but nobody took any notice

Operationalizing a question

Once you know your variables, you can rephrase your research question as a pair of hypotheses.

- E*xperimental hypothesis*: the claim you want to test the likelihood of - that the independent variable measurably and significantly influences the dependent variable.

- *Null hypothesis:* no relation between the variables.

You are testing for evidence for the experimental hypothesis and against the null hypothesis.

Design details

Any experiment is conducted with a number of

- *participants* (the people taking part)
- *items* (the things they're exposed to)

Participants

- Shouldn't know the intent of the experiment (it's OK to lie, as long as it hurts no-one and you clear it up afterwards).
- Must agree to participate, and be informed of any risks and anonymity procedures http://irb.ucsd.edu/
- Must not differ in important ways across conditions (so you shouldn't have all old people in one condition and young people in another condition if that's not what you're testing.)
- Must be representative of the population you're interested in generalizing over